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Examining language functions: A reassessment of Bastian's contribution to aphasia assessment

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Running Title: The history of aphasia assessment

Abstract

Henry Charlton Bastian (1837 -1915) developed his network model of language processing, modality deficits and correlated lesion localizations in the 1860s and was a leading clinical authority for over four decades. Although his ideas are little referenced today, having been overshadowed by his more eminent Queen Square colleague John Hughlings Jackson, his work on aphasia and paralysis was highly regarded by contemporaries. This paper traces Bastian's lasting but largely unattributed contribution to the development of standardized clinical assessment of language disorders. From 1867 onwards, Bastian trained generations of medical students in neurology. In his 1875 book *On Paralysis* there is evidence in his case

descriptions that Bastian had already implemented a detailed set of procedures for examining aphasic patients. In 1886, Bastian published a “Schema for the Examination of Aphasic and Amnesic Persons.” Bastian insisted on the utility of this battery for diagnosis, classification and lesion localization; he argued that its consistent use would allow the development of a patient corpus and the comparison of cases from other hospitals. In 1898 his *Treatise on Aphasia* included a list of 34 questions which were to be used to examine all patients to provide detailed and systematic evidence of spared and impaired abilities in all receptive and expressive modalities. Bastian’s contribution to the development of standardized clinical aphasia assessment is reassessed through detailed analysis of his publications and those of his contemporaries as well as new material from archives and casebooks.. This evidence demonstrates that his approach to diagnosis of language and other cognitive impairments has propagated through the decades. His legacy can be seen in the approach to standardized aphasia testing developed in the latter 20th century through to today.

Key words: aphasia, assessment, language, diagnosis, cognitive neurology

Introduction

In April 1897 Henry Charlton Bastian gave a series of prestigious Lumleian Lectures at the Royal College of Physicians London which were published in full in *British Medical Journal* and subsequently formed the bases of his *Treatise on Aphasia* (Bastian, 1898). This monograph was the synthesis of his life’s work on the subject, having first contributed significantly to the literature on aphasia at the inception of the field in the 1860s (Bastian, 1869a). In his *Treatise* Bastian included several chapters which represent original innovations in the clinical approach to the subject. Most notably, he presented a comprehensive scheme for examining patients in a variety of modalities with a sequence of 34 questions. This represents one of the first efforts to standardize the testing of aphasic patients. Evidence from

primary published material and unpublished archive sources indicate that Bastian had employed this systematic approach to patient assessment from his earliest years as a clinician at University College Hospital and the National Hospital for the Paralysed and Epileptic at Queen Square in London. This paper will examine the way in which Bastian's approach to bedside testing of language functions evolved, and consider the impact he had on future approaches to clinical assessment. Although rarely credited as a source, it appears that he had a profound and lasting influence in his systematic approach to using performance on particular tasks to make hypotheses about the regional diagnosis of neuropathology.

Bastian's lifelong interest in the theoretical and clinical study of acquired language disorders was marked by a number of seminal papers on aphasia (Bastian, 1869a; Bastian, 1887; Bastian, 1898) in which he developed a sophisticated model of language functions considered as input and output modalities connected in a complex network. Typically, it is Bastian's colleague John Hughlings Jackson who is the acknowledged 19th century English pioneer in the study of language disorders, named alongside the French Paul Broca and German Carl Wernicke. While very little of his legacy is remembered by aphasiologists today, in his own time Bastian's name was strongly associated with cutting edge teaching on the subject. A signal of his considered authority was Richard Quain's choice of Bastian as the contributor for the entry on 'aphasia' in his *Dictionary of Medicine*. The first edition of this groundbreaking work sold 30,000 copies and was reprinted for over 20 years. In 1880 Bastian's *Brain as an Organ of Mind* was published in the highly prestigious International Scientific Series with a double-sized initial print run alongside works by Charles Darwin, Thomas Huxley, Alexander Bain and Henry Maudsley.

Less than a decade after his death, the value of Bastian's contribution to the field of aphasia research was dismissed by Henry Head in an historical review in which he sought to elevate the standing of Jackson (Head, 1921). Bastian was disparaged by Head as a simplistic localisationist, applying the derogatory label of "diagram-maker":

"Bastian published his well-known paper in 1869 which had such an evil influence on the subsequent course of the discussion. He started from the a priori assumption that we think in words, and that words are revived in the cerebral hemispheres as remembered sounds. He talked of lesions of special fibres and centres, and set the points on the catastrophic road to schemas and diagrams. His subsequent Lettsomian Lectures ... by its simplicity and dogmatism seduced the younger generation away from the difficulties and complicities of Jackson's doctrine." (Head, 1921, p. 7)

Head was in fact the student of both Bastian at University College Hospital and Jackson at the National Hospital and looked to them as mentors and supporters in his early career. However, when Head later came to write his own text on aphasia at the end of his career (Head, 1926) and recounted the history of the previous generation's work on the topic Head presented a negative caricature of Bastian's ideas to counterpoint his positive presentation of Jackson's. In contrast to Head's representation of Bastian's ideas on the cortical localisation of function, Bastian had in fact consistently presented quite nuanced views on what constituted a functional "centre", pointing out that while there was a clinical utility in finding correlations between symptoms and pathology, this did not directly reflect localization of function (Bastian, 1869b). His motivation for employing a systematic approach to clinical assessment was to assist in the diagnosis of language disorders and the neuropathology that caused them with reference to a functional model of anatomo-clinical correlations.

A detailed examination of Bastian's published writings shows evidence of how this approach to assessment and classification of aphasic disorders evolved. Additional evidence is found in previously unexplored archival materials including patient case notes and student lecture notes from his clinical teaching. These various sources are used to trace the way in which Bastian examined and diagnosed his patients, and how he taught this method to his medical students. In his manual on the diagnosis of paralysis (Bastian, 1886), Bastian set out a protocol for testing patients with regard to language functions. This scheme is later presented in greater detail in the *Treatise* (Bastian, 1898). While this procedure for examining aphasic patients was not often directly cited by contemporaries in the clinical literature, it appears to have influenced the routine practice of many clinical colleagues and students in the late 19th century in the United Kingdom and echoes can be found in approaches used today.

Background

Although Henry Charlton Bastian (1837 -1915) was at the forefront of clinical neurology as it developed in the second half of the 19th century and was esteemed by his colleagues, little has been written about his work. Some biographical work on Bastian's neurological contributions has been carried by Jelinek (2004) and Pearce (2010), while his other area of research activity on the molecular beginnings of life has been explored by Strick (2000). This parallel career investigating issues in cellular biology will not be included for consideration here.

Bastian was born in 1837 at Truro in the southwest of England. At an early age he proved himself to be a methodical collector of observations about the natural world. He published a

Flora of the region at the age of 19 and a collection of the ferns of Great Britain a year later, both of which were presented to the Royal Cornwall Polytechnic Society (founded 1833). Bastian was apprenticed to his uncle who was a prominent Physician in Falmouth. He attended University College London, receiving his Undergraduate degree in 1859 and his Master's degree in 1861. While there he studied under the "father of modern physiology" William Sharpey and the influential evolutionary zoologist Robert Grant. He was awarded the Atkinson Morley Surgical Scholarship at University College London for 3 years. The following year he won the Longridge prize for medicine and surgery. Bastian received his Medical Degree (1st division) in 1863.

While working toward his Medical Doctorate, Bastian carried out an extensive study in his spare time on the Guineaworm ("taken from the extremities of a well-known surgeon from Bombay") (Bastian, 1863) and went on to develop a classification of the entire group of Nematode worms. The latter project resulted in a monograph in which 100 new species were described (Bastian, 1866a). While it appears that Bastian developed an allergy to them which ended these investigations (Clarke, 2008), it was in recognition of this work that Bastian became Fellow of the Royal Society at the young age of 31; his candidacy being supported by Charles Darwin and William Carpenter among others. Bastian became an early and enthusiastic convert to evolutionary thinking, being greatly influenced by Darwin's work, while becoming a lifelong friend of Herbert Spencer.

In 1863 Bastian decided to study insanity "principally on account of his liking for cerebral physiology and philosophical subjects generally" (Strick, 2000, p. 64). He served as a medical officer at the Broadmoor Criminal Lunatic Asylum from 1864-66 under Sir John

Meyer. After holding a brief post at St Mary's Hospital London, Bastian was appointed Assistant Physician at the National Hospital for the Paralysed and Epileptic in Queen Square (founded 1859) in 1867 where he was on the clinical staff until 1907. He also held a clinical appointment at the University College Hospital. He was made a Fellow of the Royal College of Physicians in 1870, and a Fellow of University College London in the same year. He was Dean of the Faculty of Medicine at University College London in 1874–6 and went on to become Professor of Clinical Medicine in 1878. For the rest of his life he divided his clinical work between University College Hospital and the National Hospital taking an active role in teaching and administration at both institutions which are located approximately a mile from each other in the central London district of Bloomsbury. His home with private research laboratory was located nearby at 8a Manchester Square only a few doors away from Jackson who lived at number 3. In addition to his clinical and teaching responsibilities, in 1884 Bastian was appointed Crown referee in legal cases of alleged insanity which was a mark of high esteem regarding his diagnostic acumen. He continued in this role until 1898 as attested by the many notices in *The Times* newspaper reports of Court proceedings.

Bastian's early contributions on aphasia

Bastian's initial medical publications reflected his interest in both experimental and clinical neurological topics (e.g., Bastian, 1866b; Bastian, 1867a; Bastian, 1867b). Bastian's earliest association with the topic of aphasia also appeared in the first year of his appointment as Assistant Physician to University College Hospital and National Hospital on a "Case of "Red Softening" of the Surface of the Left Hemisphere of the Brain: With Sudden Loss of Speech and Hemiplegia" (Bastian, 1867c). It describes the autopsy of a patient which includes an extensive discussion of the possible mechanisms which produced the neuropathology and a

consideration of the behavioural symptoms. Bastian presented a lengthy argument regarding the patient's psychological changes, as well as the aphasic and paralytic difficulties with respect to the theories of Hughlings Jackson, Edouard Brown-Séquard and Samuel Wilks.

Clinical descriptions of speech impairments up to the mid-19th century were typically anecdotal, lacking in details regarding language behaviour or consistency in methods of case reporting. After the appearance of papers by Broca (1861) in France and Jackson (1864) in England there was a huge increase of interest in and publication of descriptions of aphasic speakers, their various symptomatology and lesion localisation. There were a variety of motivations for this research; some had an interest in clinical diagnosis (e.g., Trousseau, 1865), while others were more concerned with models of laterality (e.g., Moxon, 1866). Jackson, Bastian's colleague at the National Hospital, was the most prolific English writer on the topic during the first decade or so of work on aphasia after it received its name from Trousseau (1864). With respect to the classification of aphasic patients, Jackson limited himself to a division of two types (Jackson, [1868] 2008), while the French instigator Broca attempted to develop additional terminological distinctions for various types of language disturbance (Broca 1869). Interestingly there appears to have been little substantial uptake of either Broca's terms (Henderson, 1986) or Jackson's distinctions (Head, 1921) in subsequent 19th and 20th century work on aphasia.

Henry Maudsley, who was a University College London medical school graduate two years Bastian's senior, also became interested in the topic of aphasia at this time. He was sceptical about the value of single case studies and called for a more synthetic approach. He suggested that work on aphasia research "has arrived at a stage when little or no further profit can

accrue from an aimless accumulation of observations, and what is needed is a digestion of the material which lies at hand.” (Maudsley, 1868, p. 690) It was Bastian who brought his expertise in taxonomic work in botany and zoology to bear on this problem. In 1869 Bastian offered one the earliest systematic classification systems of aphasia (Bastian, 1869a). Jacyna acknowledges his achievement in going beyond existing binary divisions to propose a more detailed scheme “in which the general order of ‘Loss of Speech’ was successively divided into different genera, species and varieties” (Jacyna, 2000, p.94).

In Bastian’s ground breaking 1869 paper on aphasia he refers to Jackson’s 1868 offering on the subject, drawing attention to the limited utility of the terminology and classification scheme offered by his colleague:

“In a paper on the ‘Physiology of Language’ read before the British Association at Norwich this year [sic], Dr. Jackson ranges the cases presenting defects in intellectual language under two principal classes: Class I, corresponds with what I have spoken of as Aphasia; and Class II comprehends the various Amnesic defects in which a lack of coordination is exhibited, cases in which there are *‘plenty of words; but mistakes in words’*...” (Italics in the original, Bastian, 1869a, p. 474)

Bastian viewed aphasia as arising from partial damage to the network of connections between sensory-motor modalities, while he viewed language fundamentally as “thinking in words”. In contrast Jackson framed aphasia as a difficulty with the ability to “propositionalise”. Head retrospectively viewed Bastian’s approach as simplistic, while he rightly argued Jackson’s showed linguistic sophistication (Head, 1926). However, Bastian’s position must be appreciated within the context of a contemporaneous debate about the relation between language and thought. For evolutionists it was important to argue for continuity between

animal communication and human speech (Darwin, 1871), while for deniers of Darwin's ideas it was the God given gift of language which set Man apart from the rest of the animal kingdom (Bateman, 1870). In his review of the literature of the day, Adolph Kussmaul acknowledged Bastian as a significant figure in this debate: "It is still a vexed question whether intelligent thought is bound up with words (Condillac, Max Mueller, Bastian, and others), or is quite independent of words (Lock, Helmholtz, Maudsley, Finkelnburg, and others)." (Kussmaul, 1877, p. 597) However, while it is clear that Bastian subscribed to the idea that we think in words, and had strong intellectual and personal ties to the evolutionary agenda, little explicit connection is made between these larger theoretical issues in his writings on aphasia. Similarly, there appears to be a surprising lack of influence of ideas regarding child language development (ontogeny) to considerations of language dissolution by clinicians in the latter half of the 19th century (Lorch and Hellal, 2010).

Bastian's description of aphasic symptoms

In 1875, Bastian published a series of eight lectures to students in *The Lancet* and in book form as *On Paralysis from Brain Diseases in its Common Forms*. The anonymous reviewer in *The Journal of Mental Science* was of the opinion that "it would be a good thing if all such lectures were as clear, as systematic, and as interesting as these are." (Bastian, 1875, p. 289) Although the title does not suggest it, Bastian discusses aphasia and other speech disorders at length. There is great attention to what is called "regional diagnosis upon regional symptomatology" which sets out many of the clinic-pathological correlations of neurology recognized today.

Detailed descriptions of patients are included as illustrative cases which provide early evidence of Bastian's approach to the clinical examination of patients with respect to the various modalities of reception and expression. For example, in the case description of a woman with epilepsy and right hemiplegia Bastian details her spontaneous speech, her ability to repeat vowel sounds, read printed words and comprehend them, point to letters, identify objects by name, count by tapping, respond to her name and address, and her spontaneous displays of emotion (Bastian 1875, p. 194-5). From the presentation of this case, the reader gets the sense that a systematic attempt was made by Bastian to test a wide range of behaviours to identify the limits of what this patient was and was not able to do. Bastian recorded specific details of both the stimuli and the patient's responses for the reader to draw their own conclusions about the nature of their impairments. In his patient reports, Bastian consistently presented clearly detailed objective descriptions of observational evidence for scientific scrutiny. He did not present the reader with unsupported assertions, or offer subjective impressions, vaguely defined labels and generalizations. This is in some contrast to the norm as represented in the published case descriptions of aphasic patients in the later decades of the 19th century in which there was little detailed description of linguistic symptoms offered by convention.

On inspection of Bastian's case notes from the Queen Square archives there is evidence that Bastian was using a systematic approach to clinical assessment from quite early on. For example, in the patient records from 1878 there are details of testing writing to dictation, copying and calculations (Bastian, 1878, p. 39-41). It is notable that Bastian wrote the tasks he used directly into his case book and pasted in the texts he used for reading and copying; the patient wrote their responses there as well. There is also an indication that at this early stage he was using a list of questions. For example, notes such as 'Q. 3 "What is your name?"

are recorded in the documentation of a clinical examination of one of Bastian's patients from the 1878 casebook.

There is also evidence from this period of the manner in which Bastian instructed medical students in the assessment of language disorders which was directly motivated by his model of functional architecture leading to diagnosis of processing difficulties. Bastian was responsible for teaching the numerous medical students at University College London from the 1860s onwards. The intake of medical students to University College London at the time was approximately 150 annually (Nixon, 1982). A record of Bastian's clinical lectures to medical students has been preserved in notes taken by a University College London medical student WL Halliburton in 1882. In his presentation on "Defects of Speech: chiefly those associated with hemiplegia" Bastian is recorded as instructing:

"The following are the six things to be looked for in all these cases:--a. Ability to understand spoken words: the patient not being deaf. If the patient cannot the auditory word centre itself deranged. b. Can the patient repeat sounds or words when requested. This tests the emission fibres from the auditory centre. An aphasic person can not do it, as it is here he is damaged. c. Can the patient write from dictation: the sound passes in to the auditory centre then in order to write, it must pass thence to the visual centre; then it passes out from the visual centres. This tests the fibres connecting the two centres. Then there are the same three things for the visual centre:--...d. Does he understand, and can he point out printed letters, and words, the patient not being blind: Can he read to himself; this tests the visual word centre. e. Can he copy written words: or more complex still change printed into written words: neither can be done if the channel from the visual centres out are not intact. f. Can he read

aloud: name objects: name printed letters. This is just the opposite to writing from dictation. The impression goes into the visual word centre, across to the auditory word centre and off from the auditory word centre.” (Halliburton, 1882, p 255-7)

This demonstrates how Bastian instructed future clinicians to systematically test input and output modalities in spoken and written language processing and draw inferences from performance to his psychological processing model.

Bastian published *Paralysis, Cerebral, Bulbar and Spinal: A Manual of Diagnosis for Students and Practitioners* in 1886. As in his 1875 book *On Paralysis*, a large portion of the text is given over to a consideration of aphasic symptoms. However, a novel inclusion was the “Schema for the Examination of Aphasic and Amnesic Patients” (Bastian, 1886, p. 125) offering a systematic approach to the testing of patients and reporting of impaired (and spared) abilities in a range of modalities. This schema contains headings which correspond to his model of four centres and a list of functions to be investigated. As such, it is a guide to what behaviours to elicit but does not provide specific instructions as to the exact tests to be conducted.

Bastian set out his motivation and rationale for this Schema which is presented in full below.

“Owing to the very varied way in which the several kinds of defect in the power of intellectual expression by Speech and Writing are combined in different cases, and yet owing, also, to the importance of exactly determining the nature of the combinations presented, it will be seen to be highly desirable, if we are to frame a correct regional diagnosis, to submit all such cases to a complete examination in accordance with some

uniform and definite scheme. By adopting such a course we may ascertain pretty accurately the nature of the disabilities from which our patient is suffering; and, at the same time, those who are not accustomed to make such examinations may more readily assure themselves that no important points, which ought to receive their attention, have been accidentally passed over. It is found only too often that in reports of different cases of an Aphasic or of an Amnesic type, the condition of the patient in reference to one, two, or perhaps several important points, receives no mention at all and thus for lack of information positive or negative in regard to this or that capacity, the record of the case is greatly diminished in value for all scientific purposes. Such a scheme I now append. It is based upon the physiological views in regard to Speech Defects which have been above expressed; but it is, I believe, sufficiently comprehensive to bring out all the facts which it is important to ascertain in reference to such cases, so far as our knowledge at present takes us. It has been used for the last four or five years by my House-Physicians in University College Hospital.” (Bastian, 1886, p. 124-5)

This passage provides a clear statement of Bastian’s conviction that in order to progress in the understanding of how language is organized in the brain and how language is compromised by brain damage, patients must be examined in a full and consistent manner. The utility of such an approach would only be fully realized if all fellow clinicians applied this comprehensive method of assessment to all patients. This would then provide case descriptions that would detail the range of selective impairments in different speech and language functions and modalities. Moreover it would allow comparisons to be made by different clinicians in different hospitals.

There was widespread acknowledgement of the value of Bastian's clinical innovation. In Charles Sajous's review of the international medical literature, particular mention of Bastian's "Schema for Examination" is made, noting it provided "...a good study of any given case of aphasia [which] is well worth reproducing." (Sajous, 1889, p. 29) While the review of this book in the *British Medical Journal* acknowledged:

"Dr. Bastian is well known as a gifted teacher, and a lucid and accurate writer on the nervous system. But he has the much higher merit of being a discoverer and an original thinker...His logical acumen and extensive practical knowledge make the reading of his book most valuable and suggestive. It will be found on the table of every man interested in the latest developments in neuro-pathology, as well as in the hands of those desirous of solving the many problems that await them at the bedside or examination-table." (Anonymous, 1887, p.734)

Contemporaneous approaches to aphasia diagnosis

Comparison of Bastian's scheme to others' approaches to the clinical assessment of neurology cases shows how far Bastian was in advance of his contemporaries. A similar manual of diagnosis from another major teaching hospital in the city, The London Hospital, is Francis Warner's *The Student's Guide to Clinical Medicine and Case Taking* (1885).

Warner's instructions for testing 'Intelligence' are: "Giving good clear answers to questions. Memory: Memory for past events, or those of recent occurrence, power to perform easy calculations. The face may temporarily or permanently lose the expression of intelligence."

The rubric Warner gives for the diagnosis of 'Speech': "Stammering. Slow, jerky. Using inarticulate sounds only. Mute. Aphasia." Further descriptors for the identification of 'Aphasia': "loss of faculty to speak words, though he can recognize them when written or

spoken”, while for ‘Amnesia’: “the loss of faculty for the memory of words, but can repeat them if suggested to him.” (Warner, 1885, p. 40-1) Even more cursory is the treatment of the subject in the 1886 edition of Samuel Fenwick’s *Guide to Medical Diagnosis*. Fenwick only gives a brief mention of aphasia, with a definition but no indication of how to test for it; nor is there any mention of the potential for modalities of expression and reception which may be differentially affected. Only Broca’s area is given as the localization of pathology (Fenwick, 1886).

There is also evidence of this type of rudimentary approach in the teaching of clinical assessment by some of Bastian’s more local colleagues. Amongst the archive papers of Thomas Barlow, there is a University College Hospital in-house pamphlet by William Gowers on *Instructions to Students for Reporting Cases*. Although it is not dated, Barlow was a medical student at University College London in the early 1870s who was taught by both Bastian and Gowers. Significant by its absence, there is no mention of any assessment or note taken of language or speech symptoms in Gowers’ instructions although a substantial portion of the caseload was comprised of patients with aphasia (Gowers, 1885a). This omission is notable as there is evidence in his case notes that Bastian had been using his own assessment system for language functions in both University College Hospital and the National Hospital on the same wards as Gowers for many years by that point.

Gowers had been a medical student at University College London in 1863 only a couple of years behind Bastian, and later became assistant physician at University College Hospital under Bastian from 1872. Gowers later resigned his post there and worked solely at the National Hospital under Jackson. The dual influence of Bastian as Gowers’ teacher at

University College Hospital and Jackson as Gowers' mentor at the National Hospital is confirmed in the opinion of Gordon Holmes (Holmes, 1954). In his lecture on 'Affections of Speech' in the series Gowers delivered on the Diagnosis of Diseases of the Brain at University College Hospital in 1885, he states: "...the views expressed in this lecture have been moulded by those of Dr. Jackson...I have adopted the phraseology that he has made, not only currently, but indispensable." (Gowers, 1885b, p. 122 fn)

In his biography of Gowers, Macdonald Critchley reflected:

"The name Gowers is not often associated with the problem of aphasia, and he mainly followed his colleague Bastian, though he did not neglect the writings of Jackson and whose phraseology he adopted.... The whole subject has afforded abundant scope for word-making; a large number of new terms have been introduced, most of which are needless, and to some extent injurious, fostering a harmful tendency to divide where it is desirable only to distinguish." (Critchley, 1949, p. 43)

These comments underscore Critchley's own strong affinity to Jackson and his rejection of Bastian's approach, in many ways similar to Head's views mentioned earlier. Nevertheless Critchley's remarks correctly emphasize Jackson's tendency to avoid the use of terminology in any consistent way when describing patients with language impairments and his resistance to the development of classification schemes, in direct contrast to the practice urged by Bastian. Gowers felt an affinity to Jackson's less systematic approach to aphasia and this attitude is reflected in Gowers' textbook which greatly influenced a wide audience of students and practitioners. However Gowers did nevertheless credit the significant contributions by Bastian.

In his *Manual of Diseases of the Nervous System* (Gowers, 1886), Gowers acknowledges a huge range of international sources and cites Bastian (1869a) second in his list of significant literature on ‘affections of speech’. It is notable that when referring to Bastian, Gowers consistently appends the title of ‘Dr.’ conveying this formal mark of respect but when citing the work of other University College Hospital or National Hospital staff he only uses surnames (e.g., Jackson) and does not distinguish in this way other clinicians with which he also had a close professional relationship. For example when discussing word deafness Gowers states: “This condition...was first described by Dr. Bastian and accurately referred to by him to the destruction of the ‘auditory perceptive centre’”. (Gowers, 1888, p. 104) He goes on to clarify Wernicke’s contribution for the localization and calls his 1874 monograph “a remarkable work”. This shows allegiance to his teacher and the merit of Bastian’s claim for priority but also credits Wernicke with something more far-reaching. In similar fashion, when Gowers discusses conduction aphasia Bastian’s priority for identifying the underlying difficulty (1869a) is also asserted over Wernicke and the latter is additionally criticised for creating a clinical term which Gowers found unhelpful.

However, there is evidence that some of Bastian’s other Queen Square colleagues had implemented Bastian’s approach to diagnosis of aphasia in their own clinics. Charles Bland Radcliffe assessed one patient with right hemiplegia and severe aphasia, recording in his case notes from 1883 (that is, before Bastian’s schema had appeared in print) that “He cannot copy; cannot name letters or figures; cannot write from dictation; cannot read to himself or out loud...” This clearly indicates that Radcliffe persisted in methodically presenting the patient with the full range of tasks in each modality as Bastian recommended even though the patient’s ability to respond was unlikely (Radcliffe, 1883-4).

Byrom Bramwell's work presents another notable contemporaneous approach to diagnosis. His *Practical Medicine and Medical Diagnosis* produced in Edinburgh in 1887 surprisingly provides no guidance on the assessment for language impairments (Bramwell, 1887). However, Bramwell did develop a clinical interest in the problem and by the time he comes to publish his own case series of aphasic patients in 1897, Bramwell cites only Charcot and Bastian as the authorities on the subject (Bramwell, 1897). Curiously, in his "Remarks on the clinical examination of cases of aphasia" published in the *Lancet* five months later Bramwell sets out a detailed rationale for assessment of aphasia based almost entirely on Bastian's model without any attribution of its source. Bramwell only states: "Several different plans of case-taking for cases of aphasia have from time to time been published. The following is based upon the difficulties encountered and the experience gained in the observation of the cases which have from time to time come under my own notice." (Bramwell, 1897, p. 789) It appears that Bramwell had over the years come to incorporate Bastian's theoretical and diagnostic model in his own approach to such a degree that he perhaps lost sight of this source of influence on his clinical thinking.

Bastian's 34 Questions

In his final work, *A Treatise on Aphasia*, Bastian includes a whole chapter dedicated to the diagnosis of speech defects. Bastian states that his motivation is to detail in a consistent manner the varied way impairments in speech and writing are combined in different patients. He points out that in many of the case reports of aphasic patients being published there is little attempt to detail the impaired and spared abilities in various modalities in a comprehensive manner thus reducing their scientific value. Bastian presents specific guidance on how to assess language functions. His schema from 1886 is now transformed into a battery of 34 points of examination (see Appendix). Bastian includes questions about

basic motor and perceptual functions which provide indications of primary neurological systems as well as being fundamental to the performance of the higher order language tasks. He acknowledges individual variation which has a bearing on interpretation as well. Handedness is documented, but also levels of education, literacy attainment in addition to reading and writing habits, musical ability and practice.

The elicitation tasks involve all domains and modalities and reflect insight into the types of potential dissociations in performance seen in patients with selective deficits. Bastian includes the assessment of spontaneous and automatic speech, repetition, reading, writing, calculation, music, and gesture. He suggests a distinction to be tested between the recognition of objects and the recognition of pictures of objects. Reading and writing are tested using a variety of techniques which acknowledge various levels of complexity involving whole words, individual letters and numerals. Testing involves letter recognition and naming, copying and transcoding from print to cursive script, comprehension of oral spelling, reading aloud and reading comprehension, tracing of written words with a finger, etc. In addition to recognition of environmental sounds and melodies, Bastian includes questions about reading and composing music. Calculation abilities are investigated and the examination of pantomime and gesture is also included.

This comprehensive approach to eliciting performances on a range of tasks acknowledges what we today would identify as different levels of processing. Bastian organized his tasks with reference to his model of auditory, verbal, visual and sensory-motor centres and the connections between them. So for example questions numbered 4-11 bear on “the activity of the Auditory Word Centre and Glosso-Kinaesthetic Centre, with their Afferent, Commissural, and Emissive Fibres.” As such this bears resemblance to the 20th century approach developed

theoretically by Norman Geschwind and clinically by Harold Goodglass and Edith Kaplan and others of the “Boston School”. Indeed, Geschwind’s original presentation of his disconnection theory (Geschwind, 1965) begins with a citation to Bastian’s work. Moreover, the *Boston Diagnostic Aphasia Examination* (Goodglass and Kaplan, 1972) explicitly adopts the type of approach instigated by Bastian for the identification of deficits in various modalities for diagnosis and classification of patients as well as contributing to theoretical models of language function (Goodglass and Geschwind, 1976).

More recently, assessments such as the Psycholinguistic Assessment of Language Processing in Aphasia (Kay *et al.*, 1992) are underpinned by reasoning Bastian initiated in his network model of connected partially independent sub-systems. The Psycholinguistic Assessment of Language Processing in Aphasia, like Bastian’s scheme of assessment, was developed as both a clinical and research tool. What has been added in these 20th century approaches to assessment is a more refined appreciation of the underlying grammatical properties of language. Nevertheless, the notion that all patients should be tested systematically with elicitation techniques to identify both spared and impaired abilities in all modalities is one that Bastian should be recognized as a pioneer. Finally, in the most recent textbook on neurology to be written by the clinicians at the National Hospital at Queen Square (Clarke *et al.*, 2009) the approach to patient examination and reasoning from symptoms to diagnosis has retained many of the key elements identified as best practice by Bastian at that hospital well over a century ago.

Conclusion

Bastian's approach to the testing of aphasic patients was developed over four decades of clinical practice with neurological patients in the latter part of the 19th century. His systematic and comprehensive approach to the assessment of language functions was evident in his clinical case descriptions, lectures to medical students and textbooks. The full details of his scheme were finally published in the *Treatise on Aphasia* (Bastian, 1898) which was the culmination of a lifetime of work on the problem.

Evidence presented here documents how Bastian's approach was incorporated into contemporary practice and the textbooks of the day largely without attribution. This debt is explicitly recognized in James Ross's influential monograph *On Aphasia* in 1887, first published in the periodical the *Medical Chronicle*. Ross states "Dr Bastian's theory is tacitly adopted throughout these pages; it has indeed, become so much the common property of psychologists that we are apt to forget to whom we owe its first enunciation, or rather, its first application to the explanation of the phenomena of aphasia." (Ross, 1887, p. 114 footnote)

This comment may be amplified to extend to the many subsequent generations of clinicians who were taught by Bastian and later by his students how to carry out bedside examinations of spoken and written expressive and receptive language functions in neurologically impaired patients. Moreover, the clinical interpretation of patterns of spared and impaired behaviour as advocated by Bastian appears to have contributed, alongside Jackson's theoretical notion of dissolution, to the development of the major late 20th century neuropsychological concept of dissociation (e.g., Shallice, 1988; Teuber, 1975). In one of the few modern citations of Bastian's scheme of examination Howard and Hatfield (1987) credit him with one of the earliest contributions to aphasia assessment: "Unlike many of his predecessors, [Bastian]... had a detailed scheme of assessment of speech disorders, linked to an examination of motor

and sensory function of the limbs. Many of his suggested sub-tests are in use today, with slight modifications.” (Howard, 1987, p. 24)

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Appendix

“SCHEMA FOR THE EXAMINATION OF APHASIC AND AMNESIC PATIENTS.”

- (1) Is the person right or left handed, and if the latter does he write with the right hand?
- (2) What is the degree of paralysis of limbs, and especially of the hand and arm?
- (3) Is he an educated person, much accustomed to read and to write?
- (4) Is he deaf, and if so to what extent, and on one or both sides?
- (5) Can he recognise ordinary sounds or noises?
- (6) Does he comprehend speech is he word-deaf, and if so, to what extent? Can he recognise his own name, or simple words when they are spelt letter by letter?
- (7) Is his spontaneous speech good? if not, to what extent is it impaired? Does he make use of occasional or recurring utterances? if so, give examples. Does he make use of wrong words (paraphasia), or mere gibberish?
- (8) Can he name the months of the year, or the days of the week? if not, can he name the letters of the alphabet, or count from 1 to 20, either by himself or after having been started?
- (9) Can he repeat short sentences, or simple words uttered before him, and if so, with what degree of readiness or distinctness?
- (10) Was he musical before his illness? and if so, can he now recognise different tunes ?
- (11) Can he sing airs, or the actual words of songs?
- (12) Is his sight good or bad? Is there homonymous hemianopsia or optic neuritis?

(13) Does he recognise printed or written words that is, is he word-blind? or can he read to himself with comprehension ?

(14) If not, can he recognise individual letters or numerals?

(15) Can he read his own writing a quarter of an hour after it has been written?

(16) If not, can he recognise short words or letters by aid of kinaesthesia ; that is, by tracing them over with his finger or a pencil, his movements, if necessary, being guided by another.

(17) Does he recognise common objects, and pictures of such objects?

(18) Does he understand pantomime and gestures?

(19) Can he write spontaneously, with correctness and freedom? if not, does he spell badly, omitting or transposing letters, or does he write wrong words (paragrammia) ?

(20) Can he write the days of the week, the letters of the alphabet, numerals from 1 to 20, or his own name?

(21) Can he copy written words in writing, or from print into writing (transfer copying)?

(22) Can he copy numerals easily, or perform simple arithmetical calculations?

(23) Can he merely copy laboriously, stroke by stroke, as though he were copying Hebrew or some drawing?

(24) If he was a musician, can he now read music?

(25) Can he compose and write music?

(26) Can he copy music?

(27) Can he express his wants by pantomime and gesture?

(28) Can he read aloud? Does he do it well or ill? and if the latter, in what respect ? Does he mispronounce words, interpolate wrong words, or utter mere jargon?

(29) Can he name at sight words, letters, or numerals?

(30) Can he name at sight common objects?

(31) Can he point to common objects whose names he hears?

(32) Can he write from dictation freely, or only with many mistakes? and if the latter, with what kind of mistakes ?

(33) Can he write from dictation individual letters or numerals?

(34) If a musician, can he play upon any musical instrument?

From Bastian, H.C. 1898 A Treatise on Aphasia and other Speech Defects, p. 306-8.